PBEEEP
State Government

Public Buildings Enhanced Energy Efficiency Program

SCREENING RESULTS FOR ST. PAUL COLLEGE

Minnesota
STATE COLLEGES
& UNIVERSITIES

SAINT PAUL COLLEGE
A Community & Technical College

February 15, 2011

Campus Overview

Saint Paul College	
Location	235 Marshall Ave, St. Paul, MN 55102
Facility Manager	Thomas Doody Physical Plant Director
Number of Buildings	2
Interior Square Footage	510,112
PBEEEP Provider	Center for Energy and Environment (Angela Vreeland)
Date Visited	January 26, 2011
Annual Energy Cost	$1,013,644 (from 2009 utility data)
Utility Company	Electric: Xcel Energy Natural Gas: Xcel Energy Hot Water: District Energy St. Paul
Site Energy Use Index (EUI)	89 kBtu/sq ft (from 2009 utility data)
Benchmark EUI (from B3)	164 kBtu/sq ft

Saint Paul College is a community and technical college that is comprised of two buildings located in St. Paul. The Main Building is 497,112 square feet and houses classrooms, laboratories, offices, shops, an auditorium, a kitchen and dining area, and a library. There is another detached building, called the CLC Building, about a block from the Main Building for Customized Training and Consulting. At the time of the screening visit, the building was vacant and in the process of being re-opened to host classes in the spring 2011 semester. There is a map of each of the buildings at the end of this report.

Screening Overview

The goal of screening is to select buildings where an in-depth energy investigation can be performed to identify energy savings opportunities that will generate savings with a relatively short (1 to 5 years) and certain payback. The screening of Saint Paul College was performed by the Center for Energy and Environment (CEE) with the assistance of the facility staff. A walk-through was conducted on January 26, 2011 and interviews with the facility staff were carried out to fully explore the status of the energy consuming equipment and their potential for recommissioning. This report is the result of that information.

Recommendation

A detailed investigation of the energy usage and energy savings opportunities of the two buildings at Saint Paul College is not recommended at this time. The floor areas in the table below have not been verified.

Building Name	State ID	Area (sq ft)	Year Built
Main Building	E26206T0164 E26206T0201 E26206T0284 E26206T0388	497,112	1964
CLC Building	E26206T0400	13,000	1968

There are many factors that are part of the decision to recommend an energy investigation of a building; at Saint Paul College the reason the buildings are not being recommended for an investigation is that the staff and management have been working with an independent consultant and would not feel a comprehensive energy investigation is warranted at this time.

Buildings Descriptions

Details obtained through the screening process regarding the Main Building are included in the following sections. The CLC Building is not discussed here because of its small size and few items of equipment.

Mechanical Equipment

The Main Building gets hot water from Saint Paul District Energy and seven heat exchangers convert heat from the district loop to the building hot water loop. There are two water-cooled chillers that provide chilled water to the air handlers throughout the building. There are 44 air handlers, most of which are Variable Air Volume (VAV). There are 279 digital VAV boxes and 68 pneumatic VAV boxes.

The following table provides a summation of the equipment in the Main Building:

Mechanical Equipment Summary Table	
2	Building Automation System (Automatrix and Tridium)
1	Building
497,112	Interior Square Feet
44	Air Handlers
279	Digital VAV Boxes
68	Pneumatic VAV Boxes
2	Make-up Air Units
~28	Exhaust Fans
2	Computer Room Air Conditioning Unit
2	Chillers
1	Cooling Tower
24	Pumps (HW, CHW, etc)
7	Heat Exchangers
2	Air Compressors

Controls and Trending

There are currently two Building Automation Systems (BAS) in place at St. Paul College, an Automatrix system and a Tridium system. There is a significant amount of equipment being controlled by both systems at the time of screening. Almost all equipment in the building is controlled by the BAS's, although there are 68 pneumatic VAV boxes and the chilled water valves for AHUs 1-8 are pneumatically controlled. Design work is currently underway to have all equipment in the building controlled by the Tridium system. Remote access to the Tridium system is possible. It is likely that both systems are capable of trending, but this has not been verified. The following building summary tables list sample points that are available for trending.

Lighting

The majority of interior lighting on campus is T8s. All of the lighting is controlled by an Intelligent Lighting Controls system, except for the classrooms and mechanical rooms. Motion sensors are also used throughout the facility.

Energy Use Index and B3 Benchmark

The site Energy Use Index (EUI) for the Main Building is 88 kBtu/sqft and the site EUI for the CLC Building is 107 kBtu/sqft. The combined site EUI for both buildings is 89 kBtu/sqft, which is 46% lower than the B3 Benchmark of 164 kBtu/sqft. In B3, the two buildings are listed together and so the B3 Benchmark is for both buildings rather than on an individual building basis.

The median site EUI for State of Minnesota buildings are 23% lower than their corresponding B3 Benchmarks, and the median EUI of MnSCU campuses is 94. This indicates that St. Paul College has limited potential to further reduce its energy use.

Metering

The Main Building has one natural gas, one electric, and one hot water (District Energy Saint Paul) meter.

Documentation

There is some mechanical documentation, including building plans, equipment schedules, operations and maintenance manuals, balance reports, and control sequences available on-site.

Observations

While the overall energy use at St Paul College appears to be reasonable, the following issues which may allow reductions in energy use were noted:

- Several air handlers are running 24 hours a day, seven days a week bringing in 100% outside air. While this is necessary when the spaces are occupied and in use, the need for outside air when the space is unoccupied and the building is closed should be examined.
- Many hallway lights were on in areas where daylight made them superfluous.

Building Summary Tables

The following tables are based on information gathered from interviews with facility staff, building walk-throughs, automation system screen-captures, and equipment documentation. The purpose of these tables is to provide the size and quantity of equipment and the level of control present in each building. It is complete and accurate to the best of our knowledge.

Main Building
State ID# E26206T0164/ E26206T0201/ E26206T0284/ E26206T0388

Area (sqft)	497,112	Year Built	1964	Occupancy	4,212

HVAC Equipment

Description	Type	Size	Notes
AH-1 Tower Classroom (A)	VAV AHU with VFDs on SF and RF	31,220 cfm 15 hp SF 5 hp RF	HW and CHW, serves 19 VAV boxes
AH-2 Tower Classroom (A)	VAV AHU with VFDs on SF and RF	29,350 cfm 15 hp SF 5 hp RF	HW and CHW, serves 25 VAV boxes
AH-3 Tower Classroom (A)	VAV AHU with VFDs on SF and RF	28,500 cfm 15 hp SF 5 hp RF	HW and CHW, serves 21 VAV boxes
AH-4 Tower Classroom (A)	VAV AHU with VFDs on SF and RF	30,900 cfm 15 hp SF 5 hp RF	HW and CHW, serves 27 VAV boxes
AH-5 Offices-Financial (A)	VAV AHU with VFDs on SF and RF	27,300 cfm 15 hp SF 10 hp RF	HW and CHW, serves 28 VAV boxes
AH-6 Tower Classroom (A)	VAV AHU with VFDs on SF and RF	24,300 cfm 10 hp SF 5 hp RF	HW and CHW, serves 20 VAV boxes

*NOTE: Equipment with an "A" after the description is controlled by the Automatrix BAS. Equipment with a "T" is controlled by the Tridium BAS. No letter after the description means the equipment is not controlled by a BAS.

HVAC Equipment Cont'd

Description	Type	Size	Notes
AH-7 Kitchen (A)	VAV AHU with VFD on SF	22,525 cfm 10 hp SF	HW and CHW, 100% OA
AH-8 Bookstore-Library (T)	VAV AHU with VFDs on SF and RF	18,985 cfm 7.5 hp SF Unknown RF hp	HW and CHW, serves 18 VAV boxes
AH-9 North Auditorium (A)	VAV AHU with VFDs on SF and RF	7,900 cfm 7.5 hp SF Unknown RF hp	HW and CHW
AH-10 S Auditorium (A)	VAV AHU with VFDs on SF and RF	7,900 cfm 7.5 hp SF Unknown RF hp	HW and CHW
AH-12 Century Center (A)	Multizone AHU with SF and RF	5,600 cfm Unknown SF hp Unknown RF hp	HW and CHW, Multizone unit serving 5 zones
AH-13 North Library (A)	VAV AHU with VFDs on SF and RF	4,775 cfm 5 hp SF 1.5 hp RF	HW and CHW, serves 2 VAV boxes
AH-23 Pipe Fitting (A)	VAV AHU with VFDs on SF and RF	4,200 cfm 7.5 hp SF 3 hp RF	HW and CHW, serves 10 VAV boxes
AH-24 Gen Trade Area (A)	VAV AHU with VFDs on SF and RF	12,500 cfm 20 hp SF 7.5 hp RF	HW and CHW, serves 25 VAV boxes
AH-25 Welding Shop (A)	AHU with 2 CV SFs and 2 EFs with VFDs	23,500 cfm 30 hp SF 40 hp RF	HW, 100% OA, Face/Bypass, heat exchanger between EA and DA.
AH-26 (T)	AHU with VFDs on SF and RF	12,100 cfm 20 hp SF 7.5 hp RF	HW and CHW, serves 5 VAV boxes
AH-27 Machine Shop (A)	VAV AHU with VFDs on SF and RF	25,700 cfm 30 hp SF 15 hp RF	HW and CHW, serves 14 VAV boxes
AH-28 Electrical (A)	VAV AHU with VFDs on SF and RF	12,350 cfm 15 hp SF 10 hp RF	HW and CHW, serves 9 VAV boxes
AH-29 Link (A)	VAV AHU with VFDs on SF and RF	11,900 cfm 15 hp SF 10 hp RF	HW and CHW, serves 13 VAV boxes
AHU 30 (T)	VAV AHU with VFDs on SF and RF	21,000 cfm 25 hp SF 15 hp RF	HW only, serves 12 VAV boxes
AHU 31 (T)	VAV AHU with VFDs on SF and RF	10,500 cfm 15 hp SF 5 hp RF	HW and CHW, serves 20 VAV boxes
AHU 32 (T)	VAV AHU with VFDs on SF and RF	20,000 cfm 30 hp SF 15 hp RF	HW only, serves 12 VAV boxes

HVAC Equipment Cont'd

Description	Type	Size	Notes
AHU 33 (T)	Constant Volume AHU with SF and RF	13,000 cfm 20 hp SF 7.5 hp RF	HW only
AHU 34 (T)	VAV AHU with VFDs on SF and RF	6,500 cfm 7.5 hp SF 3 hp RF	HW and CHW, serves 16 VAV boxes
AHU 35	Constant Volume AHU with SF	8,000 cfm 7.5 hp SF	
AHU 36 (T)	VAV AHU with 2 SFs with VFDs and 4 EFs with VFDs	22,000 cfm (2) 15 hp SFs	HW only, Heat Exchanger between OA and EA
AHU 37 (T)	VAV AHU with 2 SFs with VFDs and 2 EFs with VFDs	21,000 cfm (2) 15 hp SFs	HW only, Heat Exchanger between OA and EA
AH-38 (A)	VAV AHU with VFDs on SF and RF	46,000 cfm 40 hp SF	CHW only, serves 8 digital VAV boxes and 68 pneumatic VAV boxes
AH-39 (A)	Constant Volume AHU with SF	24,500 15 hp SF	HW only, serves 2 VAV boxes
AH-40 (A)	Constant Volume AHU with SF	7,300 cfm 5 hp SF	HW only
AH-41 (A)	Constant Volume AHU with SF	8,550 cfm 7.5 hp SF	HW and 2-stage DX cooling
AH-51 (A)	Constant Volume AHU with SF		CHW only
AH-52 (A)	Constant Volume AHU with SF		HW and CHW
AH-53 (A)	Constant Volume AHU with SF		HW and CHW
AH-54 (A)	Constant Volume AHU with SF	1,685 cfm 2 hp SF	HW, CHW, and DX cooling
AH-55 (A)	Constant Volume AHU with SF		HW only
AH-57 (A)	Constant Volume AHU with SF		HW only, 100% OA
AH-58 (A)	Constant Volume AHU with SF		HW only, 100% OA
AH-59 (A)	Constant Volume AHU with SF		HW and CHW, 100% OA
AH-60 (A)	Constant Volume AHU with SF		HW only
AH-61 (A)	Constant Volume AHU with SF		HW and CHW, 100% OA
AH-62 (A)	Constant Volume AHU with SF		HW and CHW, 100% OA
AH-63 (A)	Constant Volume AHU with SF		HW and CHW, 100% OA
AHU 64 (T)	Constant Volume AHU with SF	14,000 cfm 15 hp SF	HW and CHW, 100% OA

HVAC Equipment Cont'd

Description	Type	Size	Notes
AH-11 Kitchen-Dining MAU [A]	VAV MAU with VFDs on SF and RF		HW and CHW, serves 11 VAV boxes
AH-21 Boiler Rm MAU [A]	VAV MAU with VFD on SF	14,000 cfm 10 hp SF	HW only, 100% OA, Face/Bypass
279 Digital VAVs [A,T]	Digital Variable Air Volume Boxes	60 – 2,940 cfm each	
68 Pneum. VAV Boxes	Pneumatic Variable Air Volume Boxes	250 – 1,200 cfm each	Served by AHU 38
Chiller 1 Chiller 2	Centrifugal Water-Cooled Chillers	550 Tons each	Serve entire building
Cooling Tower	2-Cell Cooling Tower		Serves both chillers, located on roof, VFDs were recently installed
CRCU 1	Computer Room Conditioning Unit		
CRCU 2	Computer Room Conditioning Unit		
P-1 P-2	Primary CHW Pumps	15 hp each	Serve Chiller 1 and 2 Evaporators
CWP-1 CWP-2	Condenser Water Pumps	1,650 gpm 40 hp each	Serve Chiller 1 and 2 Condensers and Cooling Tower
CHW-3 CHW-4	Secondary CHW Pumps	10 hp each	Serve loop in West Tower
CHW-5 CHW-6	Secondary CHW Pumps	1,600 gpm 40 hp each	Serve loop in East Tower
CHW-7 CHW-8	Secondary CHW Pumps	25 hp each	Serve ground floor AHUs
HWP-1 HWP-2	Variable Volume HW Pumps	15 hp each	VFDs, serve West Tower
HWP-3 [A] HWP-4 [A]	Variable Volume HW Pumps	30 hp each	Serve Trade Area
HWP-5 HWP-6	HW Pump	600 gpm 20 hp each	Serve East Tower Penthouse AHUs
HWP-7 HWP-8	HW Pump	350 gpm 25 hp each	Serve West Wing AHUs, reheat, and radiation
HWP-9 HWP-10	HW Pump	15 hp each	Serve Lower Level reheats
HWP-11 HWP-12	HW Pump	3 hp each	Serve East Tower Upper Levels reheats
HWP-13 HWP-14	HW Pump	5 hp each	Serve West Tower reheats
7 HW to HW HX	HW to HW Converters		

HVAC Equipment Cont'd

Description	Type	Size	Notes
20 EFs	Exhaust Fans	< 1 hp each	
EF-802	Exhaust Fan	37,500 cfm 7.5 hp	Serves Dining Room
EF-809	Exhaust Fan	14,400 cfm 7.5 hp	Serve Boiler Room
EF-901	Exhaust Fan	1,200 cfm 1.5 hp	Serves Auto Mechanics
EF-902	Exhaust Fan	4,000 cfm 7.5 hp	Serves Auto/Truck
EF-903	Exhaust Fan	1,800 cfm 3 hp	Serves Auto/Truck
EF-904	Exhaust Fan	4,200 cfm 5 hp	Serves Truck
EF-905	Exhaust Fan	3,500 cfm 5 hp	Serves Truck
EF-906	Exhaust Fan	3,500 cfm 7.5 hp	Serves Truck
2 Air Comp's (T)	Air Compressors		Serve Auto Body (Penthouse 3) and Shops (Penthouse 2)

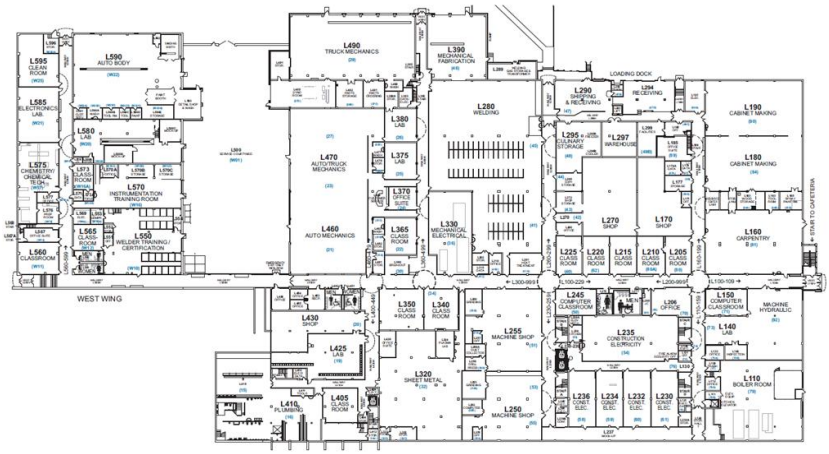
Points on BAS- Samples*

Description	Points
VAV AHU	RACO2, RAT, RARH, RF VFD speed, OA damper position, OAT, MAT, Heating valve, SF VFD speed, Cooling valve, DAT, DA DSP, DA DSP setpoint, Heating setpoint, Cooling setpoint, Economizer setpoint, HW coil supply temp, HW coil return temp, Space temp
Constant Volume AHU	RAT, RF status, OA damper position, OAT, MAT, Cooling valve, Heating valve, SF status, DAT, DARH, Space temp
VAV Box	Airflow (cfm), Damper position, Heating valve, DAT, Minimum flow, Maximum flow, Flow setpoint, Occupancy, Space temp, Occupied cool, Unoccupied cool, Occupied heat, Unoccupied heat
HWP	Pump status, Pump VFD speed, HW differential pressure, HWST, HWRT

*NOTE: These are samples of the points that are likely to be available for trending for each given type of equipment.

Building Floor Plans- Main Building

Ground Floor



First Floor

Second – Fourth Floors

NOTE: Floor plans of the CLC Building may be available, but are not included here.

PBEEEP Abbreviation Descriptions			
AHU	Air Handling Unit	HP	Horsepower
BAS	Building Automation System	HRU	Heat Recovery Unit
CD	Cold Deck	HW	Hot Water
CDW	Condenser Water	HWDP	Hot Water Differential Pressure
CDWRT	Condenser Water Return Temperature	HWP	Hot Water Pump
CDWST	Condenser Water Supply Temperature	HWRT	Hot Water Return Temperature
CFM	Cubic Feet per Minute	HWST	Hot Water Supply Temperature
CHW	Chilled Water	HX	Heat Exchanger
CHWRT	Chilled Water Return Temperature	kW	Kilowatt
CHWDP	Chilled Water Differential Pressure	kWh	Kilowatt-hour
CHWP	Chilled Water Pump	MA	Mixed Air
CHWST	Chilled Water Supply Temperature	MA Enth	Mixed Air Enthalpy
CRAC	Computer Room Air Conditioner	MARH	Mixed Air Relative Humidity
CV	Constant Volume	MAT	Mixed Air Temperature
DA	Discharge Air	MAU	Make-up Air Unit
DA Enth	Discharge Air Enthalpy	OA	Outside Air
DARH	Discharge Air Relative Humidity	OA Enth	Outside Air Enthalpy
DAT	Discharge Air Temperature	OARH	Outside Air Relative Humidity
DDC	Direct Digital Control	OAT	Outside Air Temperature
DP	Differential Pressure	Occ	Occupied
DSP	Duct Static Pressure	PTAC	Packaged Terminal Air Conditioner
DX	Direct Expansion	RA	Return Air
EA	Exhaust Air	RA Enth	Return Air Enthalpy
EAT	Exhaust Air Temperature	RARH	Return Air Relative Humidity
Econ	Economizer	RAT	Return Air Temperature
EF	Exhaust Fan	RF	Return Fan
Enth	Enthalpy	RH	Relative Humidity
ERU	Energy Recovery Unit	RTU	Rooftop Unit
FCU	Fan Coil Unit	SF	Supply Fan
FPVAV	Fan Powered VAV	Unocc	Unoccupied
FTR	Fin Tube Radiation	VAV	Variable Air Volume
GPM	Gallons per Minute	VFD	Variable Frequency Drive
HD	Hot Deck	VIGV	Variable Inlet Guide Vanes

Conversions
1 kWh = 3.412 kBtu
1 Therm = 100 kBtu
1 kBtu/hr = 1 MBH